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Automatic Number Plate Recognition

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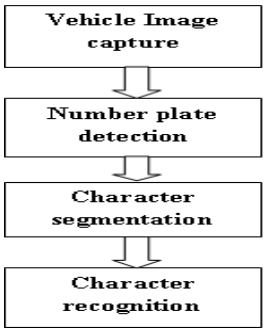
Abstract- *The main focus in this research paper is to experiment deeply with, and find alternative solutions to the image segmentation and character recognition problems within the License Plate Recognition framework. Three main stages are identified in such applications. First, it is necessary to locate and extract the license plate region from a larger scene image. Second, having a license plate region to work with, the alphanumeric characters in the plate need to be extracted from the background. Third, deliver them to an character system (BOX APPROACH)for recognition. In order to identify a vehicle by reading its license plate successfully, it is obviously necessary to locate the plate in the scene image provided by some acquisition system (e.g. video or still camera). Locating the region of interest helps in dramatically reducing both the computational expense and algorithm complexity. For example, a currently common1024x768 resolution image contains a total of 786,432pixels, while the region of interest (in this case a license plate) may account for only 10% of the image area. Also, the input to the following segmentation and recognition stages is simplified, resulting in easier algorithm design and shorter computation times. The paper mainly work with the standard license plates but the techniques, algorithms and parameters that is be used can be adjusted easily for any similar number plates even with other alpha-numeric set.*

I INTRODUCTION

The Automatic number plate recognition (ANPR) is amassing surveillance method that uses optical character recognition on images to read the license plates on vehicles. They can use existing closed-circuit television or road-rule enforcement cameras, or ones specifically designed for the task. They are used by various police forces and as a method of electronic toll collection on pay-per-use roads and monitoring traffic activity, such as red light adherence in an intersection. ANPR can be used to store the images captured by the cameras as well as the text from the license plate, with some configurable to store a photograph of the driver. Systems commonly use infrared lighting to allow the camera to take the picture at any time of the day. A powerful flash is included in at least one version of the intersection- monitoring cameras, serving both to illuminate the picture and to make the offender aware of his or her mistake. ANPR technology tends to be region-specific, owing to plate variation from place to place. The objective is to successfully locate standard number plate, segment characters and recognize them given a car image. The system must deal with different angles, distances, scales, resolutions and illumination conditions.

II PROPOSED MODEL



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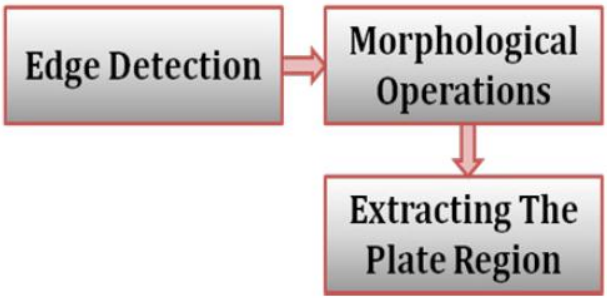
The process of automatic number plate recognition consists of four main stages:

a) Pre-processing
b) License plate localization
c) Character segmentation
d) Character recognition

1. Pre-processing:

As mentioned before, the system of automatic number plate recognition faces many challenges. So, this step is essential to enhance the input image and making it more suitable for the next processing steps. The first step done in the pre-processing is to apply minimum filter to the image in order to enhance the dark values in the image by increasing their area. This is mainly done to make the characters and the plate edges bold, and to remove the effect of the light diagonal strips that appear in the characters and edges of the license plates. This process is followed by increasing saturation of the image to increase the separation between colours. Then the image is converted to grayscale. Then increasing the image contrast to separate the background from highlights.

2. License Plate Localization:



In this stage, the location of the license plate is identified and the output of this stage will be a sub-image that contains only the license plate. This is done in two main steps.
(i) Locating a large bounding rectangle over the license plate.
(ii) Determining the exact location of the license plate.

3.Character Segmentation:

This stage is meant for segmentation of the characters from the plate. The output of this stage is a set of monochrome images for each candidate character in plate. The first step in this stage is to convert the plate image to a binary image. This is done using adaptive threshold with a window of size 11 (This is selected using trial and error). Then a process of noise removal is applied. This is done by getting the connected components from the binary image based on the 8-neighbourhood using flood fill. For every component, we decide if it's a noise or not based on the aspect ratio of the component and based on the number of pixels in that component. This is based on the fact that the characters of the plate have a certain range of aspect ratio and a certain range of number of pixels. After removing the noise components a maximum filter is applied to make the effect of thinning the characters to make sure that no two components are merged. This is followed by a horizontal paperion, to detect the boundaries between the characters to be able to cut them individually. The peaks in this paperion correspond to the gaps between the characters. So, we get all of these peaks and a rejection process is applied also, since a true plate has a fixed range of gaps between characters. So, any plate that has number of peaks that do not fit in that range, will be rejected. Also, there is a powerful rejection measure; it is the variance of the characters width (the variance of the spaces between peaks). After this the characters are cut according to the peaks of the previous paperion. Then another set of measures are computed to reject the false characters that may still exist after the noise removal operation. These measures are aspect ratio, deviation from average height test, deviation from average contrast, deviation from average brightness, deviation from hue, deviation from average saturation. After rejecting false characters, if the number of characters is not located in a predefined range, then the plate is rejected. Otherwise, the processing is continued and for every character a copy of its corresponding location in the grayscale is got. The gray level histogram is computed for the sub-image of each character, This gray level histogram will have a

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standard shape which is one peak at the dark values (this corresponds to the character's pixels) and another peak at the bright values (this corresponds to the background) and some small values between them. So, this gray level image is converted to binary using the following procedure. First, we find two peaks in the histogram then we find the minimum value in between, this will be the value of the threshold (thus, every pixel that has a gray level value less than the mentioned value, will be converted to black, every other value will be converted to white). This way for converting the grayscale image that contains only a character to binary one proved to be effective. At this point we have a set of binary images each contains one character and this is the output of this stage and the input to the next.

4. Character Recognition:

The goal of this stage is to recognize and classify the binary images that contain characters received from the previous one. After this stage every character must have a label and an error factor, and this error factor if greater than a predefined value will be used to reject false characters accidently passed from the previous steps. For the sake of classification, some features must be collected from the characters. The feature we work with in this system is the chain code of the contour of the image after dividing it into four tracks then into four sectors. Also we used a feed forward artificial neural network trained with back propagation with sigmoid activation function and the ANN is trained on the chain code feature of the optimal characters images. The neural network has 4X4X8=128input neuron, it also has 37 output neurons corresponds to the Arabic alpha-numeric set of characters except zero, it also ceil (37+128)/2) =83 hidden neurons. So, for every character we get the chain code feature and do a feed forward on the trained FFNN (Feed Forward Neural Network) then the class the corresponds to the neuron with the maximum value will the predicted class of that character. If the error exceeds a predefined value then the character is considered a false one and rejected. The plate is known to have a fixed range of characters that may appear in it, so if the total number of passed characters does not match this range, then the plate is rejected. Otherwise, the license plate number is found.

III CONCLUSION

The objective of this paper is to study and resolve algorithmic and mathematical aspects of the automatic number plate recognition systems, such as problematic of machine vision, pattern recognition, OCR and neural networks. The problematic has been divided into several chapters, according to a logical sequence of the individual recognition steps. Even though there is a strong succession of algorithms applied during the recognition process, chapters can be studied independently. ANPR solution has been tested on static snapshots of vehicles, which has been divided into several sets according to difficultness. Sets of blurry and skewed snapshots give worse recognition rates than a set of snapshots which has been captured clearly. The objective of the tests was not to find a one hundred present recognizable set of snapshots, but to test the invariance of the algorithms on random snapshots systematically classified to the sets according to their properties.

FUTURE WORK

ANPR can be further exploited for vehicle owner identification, vehicle model identification traffic control, vehicle speed control and vehicle location tracking. It can be further extended as multilingual ANPR to identify the language of characters automatically based on the training data It can provide various benefits like traffic safety enforcement, security- in case of suspicious activity by vehicle, easy to use, immediate information availability as compare to searching vehicle owner registration details manually and cost effective for any country For low resolution images some improvement algorithms like super resolution of images should be focused. Most of the ANPR focus on processing one vehicle number plate but in real-time there can be more than one vehicle number plates while the images are being captured. In multiple vehicle number plate images are considered for ANPR while in most of other systems offline images of vehicle, taken from online database are given as input to ANPR. To segment multiple vehicle number plates a coarse-to-fine strategy could be helpful.

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